in five rather loose groupings: Facets of Uncertainty (from plotting positions to the analysis of outputs from general circulation models); Novel approaches to Uncertainty (including fractals, fuzzy sets, pattern recognition and non-parametric methods); Random Fields; Time Series and Stochastic Processes; and, finally, Risk, Reliability and 'Related Criteria' (!).

It is clear from this brief outline that the term uncertainty has been given a wide interpretation. There is something to interest nearly every hydrologist, with subjects covered ranging from groundwater monitoring design, point and non-point pollutant transport modelling, analysis of rainfall data, rainfall-runoff modelling, flood frequency analysis, reservoir design and operation, reliability analysis of water resource systems, and more. The range properly reflects the widespread usage of stochastic and statistical models in hydrology today.

One area receives significantly greater coverage than any other: the application of fractal concepts to rainfall data. This is primarily because of an extended invited paper (some 42 pages) on 'Multifractals and Rain' written by Lovejoy and Schertzer and representing the best summary I have seen anywhere of both their work and that of others on this topic (including some work published well after the Madralin conference). Lovejoy and Schertzer deal with the background to fractal concepts, the problem of robust parameter calibration, and the future possibility of multifractal forecasting methods for fields and extreme statistics. Their paper is supported by other fractal rainfall analyses for rainfalls in the Sahel by Hubert *et al.*, radar data by Zawadski and high-frequency time-series data by Georgakakos *et al.* Together these provide an excellent introduction to the subject.

Interestingly, while a good many of the papers in this volume deal with the calibration of stochastic, statistical or fuzzy models by data, very few present any estimates of predictive uncertainty. Two papers by Mizumura, for example, present applications of fuzzy set theory and pattern recognition to rainfall-runoff modelling problem. In both papers there is a figure of observed and predicted discharges, both of which are represented as a single line. The errors are, for some time steps, significant, but where is the estimate of confidence in the predictions? Again, two figures of observed and predicted time series of well levels are presented by Feluch, with data and predictions also presented as single lines without estimates of prediction confidence. There are likewise a number of figures throughout the volume from different studies of flood discharge exceedance predictions. The paper by Guo Sheng Lian, in particular, compares several different distributions fitted by non-parametric methods. The exceedances are plotted to return periods of greater than 500 years. The estimates are clearly probabilistic, differ greatly between the distributions, but do not, as presented, appear to be uncertain!

A plea is thus made here for hydrologists to be more circumspect about making predictions without associated estimates of the uncertainty in those predictions. The presentations in this volume demonstrate that, in some ways, there is an increasing awareness and range of techniques available for dealing with the natural heterogeneity and non-stationarity of hydrological variables. Risk and reliability analyses are available for taking account of probabilistic estimates of the occurrence of events and of conjunctions of events, perhaps using multiple realizations generated from some model of the process. There appears to be much less appreciation and use of the fact that the approximations inherent in those models lead to additional uncertainty. There seems to be no inherent technical reason why this should be so; perhaps making multiple realizations of a model for many multiple realizations of its parameters is still computationally too demanding for many applications. Then there is the added problem of uncertainty arising from different model representations . . .

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COASTAL PROBLEMS: GEOMORPHOLOGY, ECOLOGY AND SOCIETY AT THE COAST by Heather Viles and Tom Spencer, Edward Arnold, London, 1995. No. of pages: x + 350. Price: £40.00 (hb), £15.99 (pb). ISBN 0-340-62540-6.

I thoroughly enjoyed reading this book. Viles and Spencer have accomplished the difficult task of writing a book which explains the workings of coastal systems and problems that affect them in a language that is accessible to the lay reader, student and teacher. The book 'aims to elucidate the ecological, geomorphological and to a lesser extent, societal setting of coastal problems with a view to improving the success of coastal management'. Viles and Spencer define coastal problems as 'natural and/or human-induced events or processes that affect environment and society at the coast' and explore this subject from a holistic perspective which appreciates the interdependence of people, natural processes and ecology in generating and expressing these issues. A consistent theme throughout the book is the need to understand why coasts are problematic, in order to work with the problems to mitigate their effects.

On a cautionary note, the enormous scope of the book has resulted in a tendency to a generalized approach which fails to add satisfactory depth to certain subjects which may disappoint the serious scholar. However,

this is not so much a criticism as an inevitability. Any book on coastal problems must first explain how the coastal biogeographical systems operate before one can develop an understanding of the problematic consequences of those operations. The authors have commendably attempted to overcome this problem by directing the determined reader to fuller texts where subjects are covered in greater detail, and by supplying an extensive list of references (over 600) as well as embellishing the text with a wealth of referenced examples.

The first chapter (The coastal context) introduces the varying nature, scope, scale and impact of coastal problems, but also outlines Viles and Spencer's holistic appreciation of coastal problems and their mitigation. Chapter 2 (How coasts work) offers a sketchy but nevertheless useful introduction to coastal studies, covering the classification of coasts, waves, tides, coastal ecology and its disturbance, and the nature of sea-level change. The strengths of Viles and Spencer's book lies in the main body of chapters covering different coastal systems and their associated problems, including beaches and dunes, cliffs and rock platforms, wetlands, coral reefs, and glaciated and high-latitude coasts. In each chapter, a general introduction to the functioning of the systems is presented (with reference to more detailed texts) followed by a discussion of a wide range of related coastal problems. These problems are well explained, with numerous examples cited, with documentation of strategies adopted in an attempt to mitigate their effects. The breadth and diversity of coastal problems addressed are to be commended. Each of these chapters also has two or more useful case studies which illustrate the complexities of typical problems as well as acting as a valuable resource for teaching material. In concluding, the authors concentrate on the human dimension to coastal problems illustrated by detailed case studies from two highly populated and vulnerable coastal zones: the Bay of Bengal and the Mediterranean.

Viles and Spencer have succeeded in writing an informative, readable and provocative text which will act as a valuable resource as well as facilitating access to literature on this often elusive but important subject. For interested readers, students and, with its numerous examples, teachers, this is a good buy. For those directly involved in coastal planning issues, as Viles and Spencer point out, deep understanding of coastal processes is required, and here this book will only start you on your journey.

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